POSTOPERATIVE ANTIBACTERIAL PROPHYLAXIS IN VASCULAR SURGERY: ANALYSIS OF ITS PARAMETERS BEFORE AND AFTER EVALUATION OF JUSTIFICATION OF CHOSEN INDICATIONS

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Summary

In surgical practice, antibacterial prophylaxis (AP) is widely used to reduce the risk of possible infectious complications; it is not always administrated according to evidence-based clinical indications. Administration of AP in cases when its inefficiency for exact situation has been scientifically proven, should be considered as unwarranted. A one-year-long retrospective analysis of AP cases in the Department of Vascular Surgery of Pauls Stradins Clinical University Hospital was performed and the results were broadly analyzed within the local structural unit. It was followed by the development of the local guidelines for administration of antibiotics, as a result, a significant decrease in cases of unwarranted AP has been achieved.

Keywords: antibacterial prophylaxis, vascular surgery

INTRODUCTION

Infectious complications are one of the most frequent complications of surgical therapy, which complicates and prolongs the treatment process, increases its costs, and are accompanied with high mortality rate (2, 16). Surgical site infection (SSI) is the most common one, with different incidence rates in different surgical specialties. In vascular surgery, it varies by the type of surgical intervention, overall up to 27 %. (15, 9) The specification of vascular surgery requires frequent use of synthetic materials (vascular prostheses and patches), which, in case of infection, is associated with higher threats. Vascular graft infection (VGI) occurs in 0,5% to 6%, but is particularly significant due to frequent lower limb amputations (up to 70%) and high mortality rate (15-75%). (10, 13)

On the one hand, several clinical risk factors have been related to these infections such as diabetes mellitus (3, 5, 8, 12, 15, 18, 19), tissue ischaemia due to vasculopathy (5, 13, 15, 17, 19), obesity (8, 10, 15, 17, 19), reoperation due to surgical site hematoma (6, 7, 8, 11). There are several possible pathogenetic mechanisms for an early VGI, but the main risk factor is SSI. (8) Therefore it can be considered that the risk factors for the vascular graft infections are the same as for SSI.

On the other hand, antibiotic prophylaxis (AP) is being applied frequently for the purpose of reducing the risk of infectious complications. Nevertheless studies do not demonstrate the achievement of expected benefits in all cases. Reduced risk of infectious complications has been approved for administration of AP preoperatively. However, AP prolongation for more than 24 hours after a surgery does not have the same reducing effect,

but increases the risk of the side effects of antibiotics. (8, 4, 14, 1, 15) It should be noted that there is a lack of studies analysing effects of postoperative antibiotic prophylaxis (PAP) for patients with predisposing factors to infection, mentioned before. In these cases the decision about PAP – to administer it or not, the duration and other characteristics of PAP – is made based on a physician's individual consideration. However, in cases when a patient has no risk factors for increased infectious complications, PAP should be considered as unwarranted. Moreover, the unreasonable use of antibacterial agents should be eliminated in the context of antimicrobial resistance problem.

THE STUDY DESCRIPTION

A retrospective analysis of the surgical procedures was performed in the Department of Vascular Surgery (DVS) of Pauls Stradins Clinical University Hospital (PSCUH) from 1st January, 2018 to 31st December, 2018 (a calendar year) using the following criteria:

- primary diagnosis the surgery was performed for;
- information about the surgical intervention;
- information about the patient-related risk factors for higher infection risk;
- duration of received AP.

The data as statistical summary was presented and analysed during the PSCUH DVS session on 8th March, 2019. In cooperation with the Infection Surveillance Service the guidelines for the use of antibacterial agents have been developed. In order to analyse, whether the evaluation of systematic habits of individual physicians and the development of local guidelines have changed the previous habitual practice of administration of unwarranted PAP, the data of performed surgeries in

PSCUH DVS from 11th March, 2019 to 11th July, 2019 (a trimester of a calendar year following the session) were collected and analysed.

At the same time the data about SSI and VGI cases from 1st January, 2018 to 11th July 2019 were collected. An excluding criteria for both, SSI and VGI, was a surgery performed on an active infection already existing, and for VGI cases – graft implantation performed before the time period of the review.

RESULTS

The total number of PAP cases (both with and without risk factors for increased infectious complications) registered in 2018 was 671, with a proportion to total surgical intervention cases of 56,10 %. The data about the patients who received the surgery and were administered unwarranted PAP from 1st January to 31st December, 2018 are shown in Table 1.

Dividing general groups more precisely, unwarranted PAP is most frequent after the endarterectomies of the abdominal aorta, iliac and femoral arteries (in 96 of 242 interventions or in 39,67 %), thrombembolotomies from the arteries of the lower limb (in 10 of 41 interventions or in 24,39%), bypass surgery of the popliteal and crural arteries (in 15 of 107 interventions or in 14,02%) bypass surgery of abdominal aorta, iliac and femoral arteries (in 22 of 204 interventions or in 10,78%). Based on these results, the conclusion is made, that in clinical practice surgical intervention on the arteries of the lower limb by physicians is considered as the indication for PAP, nevertheless it is not an evidence-based argument. Of the total 399 performed endarterectomies of the carotid artery in 15 cases (3,67%) PAP was administered with an average duration 2,53 days, although the risk for infectious complications after the surgery on carotid artery statistically is one of the lowest ones.

In 59,17 % duration of PAP was longer than one day (an average 2,75 days). The amplitude of the average duration of PAT analysed by each physician separately was calculated from 1,22 to 4,29 days.

The data about the patients who received the surgery and were administered unwarranted PAP from 11th May to 11th July 2019 are shown in Table 2.

To realise if the habitual practice of administration of unwarranted PAP has changed, the data about both periods were compared and illustrated in Figure 1.

The number of unwarranted PAP cases has been completely reduced both in the group of reconstructions of the carotid and subclavian artery and extra-anatomical bypass surgery. Also a decrease was observed in the following groups: reconstructions of the abdominal aorta, iliac and femoral arteries (- 10,70 %), extra-anatomical bypass surgery (- 9,68 %), others (- 8,66 %).

An increase was observed in the following groups: reconstructions of the popliteal and crural arteries (+ 3,63 %), endovascular surgery (+ 2,05 %). Due to the low number of interventions in some groups (Table 2.), the calculated percentage may not accurately

reflect the true situation in the longer period of time. To avoid such a statistical error, data registration should be continued. The highest frequency of unwarranted PAP still remains to endarterectomies of the abdominal aorta, iliac and femoral arteries (20,00%) and bypass surgery on popliteal and crural arteries (17,65%). Reduction of the total frequency of unwarranted PAP has been calculated as 6,97 %.

Out of 33 cases of unwarranted PAP (an average duration 2,27 days), in 15 (45,46%) the treatment has been administered for more than one day, and 14 cases of them have been reported to the same physician with an average duration of 3,57 days.

The total number of PAP cases (both, with and without risk factors for increased infectious complications) registered in the trimester of 2019 is 138, with a proportion to total surgical intervention cases of 29,94% (a decrease of 25,5%).

As to these changes, at the same time no negative impact has been identified on the frequency of SSI (9 cases in 2018, 2 cases in the trimester of 2019) or VGI (5 cases in 2018, 1 case in the trimester of 2019).

CONCLUSIONS

1. The efficiency of postoperative antibacterial prophylaxis has not been established. Nevertheless, it is widely administered to patients with no risk factors for increased infectious complications, exposing them to the risk for developing antibiotic agent caused side effects and promoting the evolution of antibiotic resistance.
2. There is a lack of precise guidelines of the necessity of postoperative antibiotic prophylaxis for patients with clinically increased risks for infectious complications (but no infection).
3. The analysis of cases of antibacterial prophylaxis is recommended within the hospital or its structural unit to decrease the frequency of unwarranted administration of antibacterial agents.
4. It is recommended to analyse other parameters of antibacterial prophylaxis – antibacterial agents that are used in therapy, their combinations, the frequency of complications etc.

Conflict of interest: None

Table 1. Frequency of unwarranted AP cases different groups of performed surgery in 2018.

	Total number of operations performed	Cases with unwarranted AP	proportion to number of operations performed in the group
	abs.	abs.	%
Reconstructions of the carotid and subclavian arteries	409	15	3,67
Reconstructions of the abdominal aorta, iliac and femoral arteries	487	118	24,23
Reconstructions of the popliteal and crural arteries	107	15	14,02
Extra-anatomical bypass surgery	31	3	9,68
Thrombembolectomies	60	12	20,00
Endovascular surgery	80	2	2,50
Others	22	4	18,18
Total	1196	169	14,13

Table 2. Frequency of unwarranted AP cases different groups of performed surgery in the trimester of 2019.

	Total number of operations performed	Cases with unwarranted AP	proportion to number of operations performed in the group
	abs.	abs.	%
Reconstructions of the carotid and subclavian arteries	187	0	0,00
Reconstructions of the abdominal aorta, iliac and femoral arteries	170	23	13,53
Reconstructions of the popliteal and crural arteries	34	6	17,65
Extra-anatomical bypass surgery	13	0	0,00
Thrombembolectomies	14	1	7,14
Endovascular surgery	22	1	4,55
Others	21	2	9,52
Total	461	33	7,16

Fig. 1. Changes in the proportion of cases with unwarranted PAP by the each group of performed surgery

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